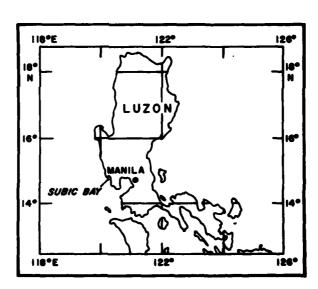


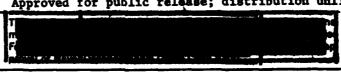
INFORMAL REPORT

ENVIRONMENTAL DATA REPORT SUBIC BAY, REPUBLIC OF THE PHILIPPINES, JANUARY AND FEBRUARY 1965



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NAVAL OCEANOGRAPHIC OFFICE WASHINGTON, D.C. 20390

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ABSTRACT

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965. The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program. Temperature and salinity measurements and bottom sediment samples were obtained at 10 stations. Two of these stations were time-series anchor stations with current measurements and ambient noise recordings.

The influence of tidal currents are thought to be responsible for the fluctuation of higher density waters through the entrance channel to Subic Bay on either slope of predicted high water.

Maximum current speed was 0.4 knot. Characteristically, flow direction at intermediate levels often differed from the flow of the surface and near-bottom depths.

DALE E. KENNEY
Nearshore Surveys Division
Oceanographic Surveys Department

This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Report.

L. B. BERTHOLF

Director, Nearshore Surveys Divison

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I. INTRODUCTION

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965 from USS ENERGY (MSO 436) and USS ABNAKI (ATF 96). The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program.

Ten Nansen cast stations were occupied: seven stations along a track in the approaches to Subic Bay on 22 January and three stations, two of which were time-series anchor stations with current measurements and ambient noise recordings, in the entrance channel between Grande Island and Macmany Point from 17 to 19 Februar. (Fig. 1). A station data summary is presented in Table I.

Subic Bay is a deep, semi-enclosed basin with steep sides and a generally mud bottom. The bay gradually shallows from the entrance channel near Grande Island northward to the shoreline. The climatology is largely influenced by the monsoons and the trade winds. Current flow seaward of Subic Bay generally sets northward throughout the year with the stronger currents associated with the summer months. The northeast monsoon, November to March, brings weaker currents and drier weather.

II. METHODS OF COLLECTION AND ANALYSIS

A. Temperature.

Six to 12 Nansen bottles were used per cast, and with the exception of station 1, only paired, protected reversing thermometers were utilized. By alternating individual thermometers and forming new pairs, a reliable temperature relationship among the thermometers was established. Consequently, a correction factor could be applied to certain thermometers that had consistent errors. This factor, along with the standard thermometer corrections, was applied to the temperature values, and temperatures are considered accurate to +0.02°C.

B. Salinity.

Water samples were drawn from Nansen bottles, and salinity determinations were made in the field with an Industrial Instruments RS-7A induction salinometer. With this instrument, salinity can be measured with a precision of ±0.003 o/oo. In consideration of the probable sources of error, instrumental and observational, an accuracy of ±0.01 o/oo is realistic for this survey.

C. Bottom Sediments.

Kullenberg cores were obtained at stations 8, 9, and 10. The samples were analyzed in the field for engineering properties and



sediment size and composition. Some distortion in the cores resulted before analysis, and the values obtained for the engineering properties are questionable.

D. Current Measurements.

Five Roberts current meters were used to obtain currents at the time-series stations. Because of the proximity of stations 9 and 10, the data are presented as one continual station covering a 36-hour period (24 and 16 hours each, respectively). The time gap occurred in the record when ship relocation and equipment malfunction halted operations. Current observation depths ranged from the surface to near bottom.

The calibration limitations of the Roberts current meter is 0.2 to 5.0 knots. Many values obtained were near 0.1 knot, which is the approximate threshold level for the meter. If a discernable record was attained near the threshold level, the measurement was included in the analysis. Of the 128 current observations attempted, approximately 35 percent were unusable and an additional 16 percent of the observations showed current speeds below the threshold level of the meters. The current directional values are considered accurate to +10 degrees.

E. Ambient Noise.

Ambient noise was measured with an AN/PQM-1A Noise Level Meter. The meter has a frequency range of 20 to 40,000 Hz and a pressure level range of 30 to 145 decibels referred to a reference level of 0.0002 dynes/cm².

The hydrophone was mounted on a tripod located 180 meters east of station 10 at a depth of 24 meters. Recordings were obtained for 3-minute intervals 30 minutes before sunrise and 30 minutes after sunset. The calibration and the recording of ambient noise followed the technique outlined in the AN/PQM-1A instruction manual. The data obtained were analyzed on an 8-channel Sanborn recorder using a B&K 3rd octave spectrometer. The values used in this report are the average sound pressure level of the central frequency of each 1/3 octave corrected for attenuation, cable, and equipment loss. The resulting sound pressure levels then were reduced to sound pressure spectrum levels for analysis.

F. Meteorological and Tide Observations.

NAVOCEANO personnel obtained meteorological observations either visually or by hand-held equipment. Tide values used in this report are predicted values from USC&GS tide tables with Manila as the reference station.



III. DISPOSITION OF DATA

The serial-depth temperature and salinity values were computer processed at NAVOCEANO. Machine listings provided electrical conductivity, density (sigma-t), and sound velocity determinations for each depth. The computer-processed station data sheets are presented in Appendix A.

The core analysis summary sheets are presented in Appendix B. Original current data and ambient noise recordings are retained at NAVOCEANO.

IV. PRELIMINARY ANALYSES

A. Temperature.

A temperature cross section of stations 1 through 7 is shown in Figure 2. A density-time-depth composite for Station 10, indirectly depicting the hourly thermohaline variations occurring for each recorded depth, is presented in Figure 3.

Temperature measurements taken hourly during the time-series stations showed that the maximum horizontal fluctuation did not exceed 1.1°C for any measured depth over the 36-hour period of observations. Measurements of the vertical temperature range revealed a maximum variation of 1.6°C within the water column. Relatively little fluctuation in horizontal temperature was evident while occupying Station 9. With the advent of the following flood tide, subsequent changes in the temperature and salinity structure resulted in density fluctuations for all observed subsurface depths (Fig. 3). The increases in density appeared on either slope of predicted High Water.

B. Salinity.

Salinity values ranged from 33.49 to 34.47 o/oo. Figure 4 is a salinity cross section for stations 1 through 7. Observations taken during the time-series stations showed a maximum hourly range in vertical salinity of 0.34 o/oo. For any one observed depth, maximum horizontal fluctuation in salinity was 0.25 o/oo. The stability of the water column for the first 24 hours (Station 9) was attested to by a maximum horizontal fluctuation of 0.11 o/oo. Subsequent measurements revealed slight increases in salinity accompanying the temperature decreases, resulting in the density fluctuations depicted in Figure 3.

C. Bottom Sediments.

The core samples showed a generally greenish-colored sand with high contents of clays and silts. Calcium carbonate comprised, by weight, 18 to 37 percent of the samples' mineral composition. Quartz and calcite were the dominant and secondary minerals, respectively. The high standard deviations evident in the sediment size analyses attest to the poorly sorted nature of the sediments.



D. Current Measurements.

Current measurements also are depicted in Figure 3. Maximum recorded current speed was 0.4 knot. Current speed and direction varied throughout the water column. Characteristically, flow direction at intermediate levels often differed from the flow at the surface and near-bottom depths. Observed near-bottom flow was an inflowing current for the full 36-hour period regardless of the tidal cycle. Surface currents appeared to be in harmony with the tidal cycle more so than subsurface flows: The termination of a tidal period generated a reversal in surface flow direction. The increases in density at Station 10 indicated a fluctuation of higher density water through the entrance channel as a result of tidal currents.

E. Ambient Noise.

Recognizable sound sources evident to the observers were snapping shrimp and a channel buoy. Therefore, the recording times were chosen to correspond to the periods of maximum activity of snapping shrimp, which were thought to be the dominant noise source. The rise in the sound pressure level between 2kHz and 20kHz (Fig. 5) is compatible with prior research' on the role of snapping shrimp in the production of underwater noise. Observed sea state levels did not exceed "two" during the recordings, and Knudsen's curves for ambient noise levels are presented in Figure 5.

Transient noise anomalies were present in the lower frequencies, especially during the morning recordings. The occurrence of the transient noise anomalies decreased from a maximum in the 40 to 125Hz band widths to an insignificant amount over 2.5kHz. Besides the sound from the channel buoy and random noises from the listening ship, the low frequency transient noise sources were not identifiable.

^{&#}x27;M.W. Johnson, F.A. Everest, and R.W. Young. 1947. The Role of Snapping Shrimp (Crangon and Synalpheus) in the Production of Underwater Noise in the Sea. Biol. Bull. Woods Hole, 93(2): 122-138.

² V.M. Albers. 1965. Underwater Acoustic Handbook II. Pennsylvania State University Press.

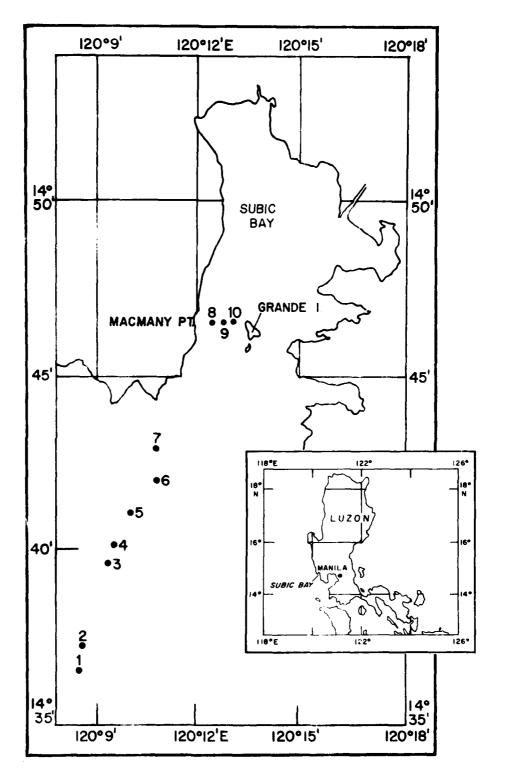


Figure 1. Station Locations

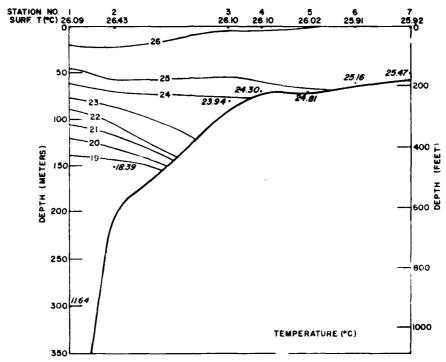


Figure 2. Temperature Cross Section - Stations 1 to 7

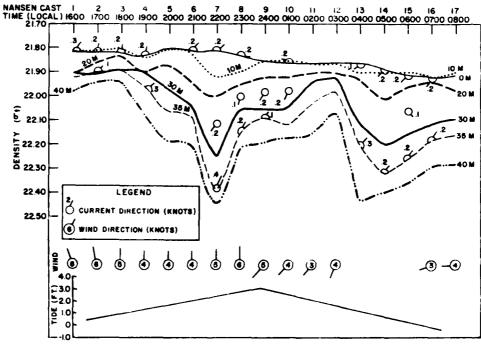


Figure 3. Density-Time-Depth Composite at Station 10

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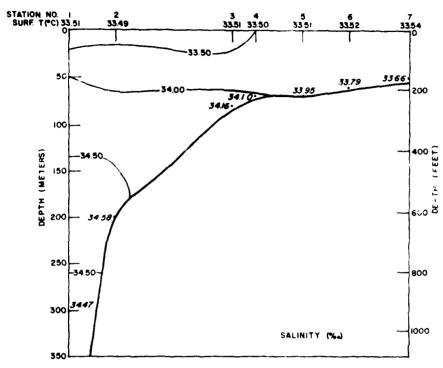


Figure 4. Salinity Cross Section - Stations 1 to 7

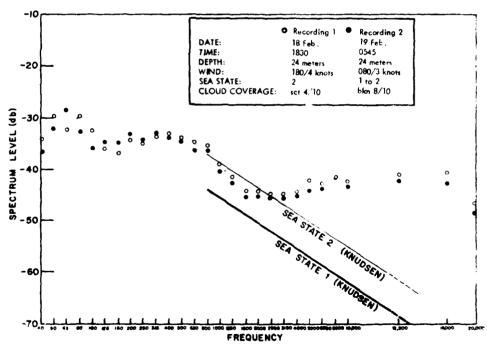


Figure 5. Sound Prassure Spectrum Level

TABLE I. STATION DATA SUMMARY

Sta. No.	Latitude (°N)	Longitude (°E)	Depth (meters)	Nansen Casts	Current Meter Lowerings	Cores	Ambient Noise Recordings
1	14°36.30'	120°08.60'	·713	1			
2	14°37.25'	120°08. <i>7</i> 0'	205	1			
3	14°39.60'	120°09.30'	91	1	•		
4	14°40.20'	120°09.70'	7 3	1			
5	14°41.05'	120°10.20'	<i>7</i> 3	1			
6	14°42.00'	120°10.50'	64	1			
7	14°43.00'	120°11.25'	58	1			
8	14 °46.60'	120°12.30'	60	1	1	1	
9	14 °46.60'	120°12.60'	55	24	17	1	
10	14° 46 .6 0'	120°12.90'	43	17	15	1	2

APPENDIX A
Oceanographic Station Data

EXPLANATION OF COMPUTER DATA SHEET OCEANOGRAPHIC STATION DATA

- 1. CRUISE. A number assigned to each cruise for identification purposes. The first two digits are the mine division number, the next three digits are the ship's hull number, and the last digit is the end digit of the year.
- 2. STATION. The station identification consists of an area abbreviation (SEA = Southeast Asia), a region number, and a consecutive station number for the cruise.
- 3. LATITUDE. Expressed in degrees, minutes, and tenths of minutes.
- 4. LONGITUDE. Expressed in degrees, minutes, and tenths of minutes.
- MARSDEN SQUARE. A 10-degree geographical square used for cataloging data.
- 6. DATE. Day, month, and year when data were taken.
- 7. TIME. Time of day when data were taken in local time.
- 8. ZONE. Time zone for converting local time to GMT.
- 9. DEPTH. Depth of water in meters where station was taken.
- 10. AIR TEMP. Temperature of the air in *F when station was taken.
- 11. TEMP INSTR. Type of temperature recording instrument used for collecting the water temperatures (RTH= reversing oceanographic thermometer, MBT= mechanical bathythermograph).
- 12. SAL INSTR. Type of instrument used to obtain salinity samples of water (NAN= Nansen bottle).
- 13. DEPTH. Depth in meters at which each temperature and salinity sampling was made.
- 14. DEV. The + range of depth over which actual sampling depth may deviate from given sampling depth.
- 15. TEMP. Water temperature in °C at each sampling depth.
- 16. DEV. The + range of temperature over which actual temperature may deviate from given temperature value.
- 17. SALINITY. Water salinity in parts per thousand at each sampling depth.



- 18. DEV. The + range of salinity over which actual salinity may deviate from the given value.
- 19. ELEC. COND. The electrical conductivity of the water in mhos/cm² calculated from the values of temperature and salinity with the empirical equation of Ribe and Howe, "An Empirical Equation Relating Sea Water Salinity, Temperature, Pressure, and Electrical Conductivity."
- 20. DEV. The + range of electrical conductivity over which the actual conductivity may deviate from the given value, computed from the deviations of temperature and salinity.
- 21. $\frac{\text{SIGMA-T}}{1000 + 1}$ and abbreviated expression for density (density= Sigma-t/ $\frac{1000 + 1}{1000 + 1}$) g/cm³ calculated with the equation of Knudsen using the given temperature and salinity values.
- 22. DEV. The + range of Sigma-t over which the actual Sigma-t may deviate from the given value, computed from the deviations of temperature and salinity.
- 23. SOUND VEL. The velocity of sound in sea water at each depth, in meters per second, calculated from the given values of depth, temperature, and salinity using Wilson's equations of 1960, NAVOCEANO Special Publication 58, "Tables of Sound Speed in Sea Water."
- 24. DEV. The + range of sound velocity over which the actual sound velocity may deviate from the given value, computed from the deviations of depth, temperature, and salinity.

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	0.0	33.55	1.00		0.000	21.92	00.0	1536.1	0.07
	5.0 0.0	33.60	(•01		20000	22.00	0.00	1536.0	0.07
0.1	3.6 3.6	33.69			0.00	75.20	00.0	1535.3	- C-
	0.0 6.4	33.49			0.000	22.60	0.00	1333.8	BO . O

									-
0. PTH 0EV.	ENP DEV	SALINITY	nev.	6	CEV.	SICHA-T	DEV.	SCUND VEL.	DEV.
1.0	6.4 3.0	33.55	0.01		00000		00.0	1536.6	20.0
5	6.1 0.0	33.56	0.01		0.000		00.0	1536.1	0.07
٠, ١, ١	0.1 0.0	33.57	10.0		2000.0		0.00	1536.1	0.07
3. 1.0	0.0 6.9	33.59	01	0.0522	0000	21.99	00.0	1536.1	0.07
5. 1.0	5.5 3.0	23.67	15.		0000.0	i	00.0	1535.3	0.07
	3	33.85	C.01	! !	2000.0	1	00.0	1534.0	0.08
CAUISE 965	STATION SEA	4 4 9	LATITUD	LATITUDE 14 46.6 N	LONGI TUDE	TUDE 120	12.6 E	PARSDEN S	SOUARE
041E 17 FEB 65	S TIME 1460	SCNE -8	DEPTH	55 AIR	TEMP 85.0	TEMP	INSTR ATH	SAL IN	INSTR NAN
	!								
DEPTH DEV.	100	SALINITY	CEV.	ELEC. COND.	CEV.	L		SOUND VEL.	OEV.
٠,	26.5 0.02	33.56	0.01	9250	000000		00-0	1536.8	0.07
1.0	o	33.55	0:01		0000.0	}	00.0	1536.1	0.07
~	0	33.57	C.01	0.0522	2000.0		00.0	1536.2	0.07
	0	33.59	0.01	0.0522	0.0000		. 00.0	1536.2	0.0
	ò	33.68	0.01	0.0519	0.000	22.18	0.0	1535.4	0.0
	0.0 0.0	33.87	10.7	C.0282	0000.0	27.22	0.01	1448.6	0.03
CRUISE - 365	STATION	SEA 4 9	LATITUDE	DE 14 46.6 N	PICNG	LCNGÍTUBE 120	120 12.6 E	MARSCEN	SQUARE
DATE 17 FEB (65 TIME 1500	SCNE 8	DEPTH	SS AIR	TEMP 84.0	TEMP	INSTR RTH	SAL	INSTR NAN
•								: J	
TH DEV	10 0.3	E.	DEV.	ELEC. COND.	CEV.	STCPA-T	DEV.	SCUND VEL.	DEV.
0.1	6.4	3.5	10.0	0.0525	0.000	21.83	00.0	1536.6	20.0
1.0	6.2 0.	3.5		0.0522	0.00.0	21.92	00.00	1536.1	0.07
1.0	6.1 0.	•	0.01	0.0522	000000	21.94	00.0	1536.2	0.07
30. 1.00	26.1 0.02	w.	10.0	0.0522	0.000	21.97	00.0	1536.2	0.0
· ·	2.0	٠	-						

CAUISE - 365	STATTON SEA	•	LATITUUL	1 14 46.6 N	LONG	LONGITUCE 120	12.6 E	PARSCEN	SQUARE 0
DATE 17 FER 62	TIME 1600	10ve - 9	06.0 1+	SS AIR	TEMP 82.0	1689	INSTA RTH	SAL .	INSTR NAN
0.4TH 0EV. 0.1 1.00 15. 1.00 25. 1.00 36. 1.00 35. 1.00	76 P DEV. 26.2 0.02 26.2 0.02 26.1 0.02 25.1 25.2 25.2 25.2 25.2 25.2 25.2 25.	SAL INTTY 33.52 33.52 33.53 33.53 33.63) >6000000 200000	ELEC. COMO. 0.0522 0.0522 0.0522 0.0519 0.0519	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	SIGHA-T 21.89 21.90 21.93 22.12 22.12	00000000000000000000000000000000000000	SQUND VEL. 1535.9 1536.3 1536.3 1535.5 1535.5	000000 000000 000000
CRUISE - 965	STATION SEA	0 4	LATITUDE	DE 14 46.6 N		LCNG1TUDE 120	120 12.6 E	MARSCEN	SQUARE
DATE 17 FEB 65	11ME 1700	ZCNE 8	CEPTH	SS ATR	TEMP 82.0		TEMP INSTR RTH	SAL	INSTR NAN
7. FF	DEV	SALINITY	DEV.	ELEC. COND.		SIGMA-T	DEV.	SCUND VEL.	- 1
	000	33.52	100	0.0522	0000	21.89	600	1536.1	20.07
•	20.0 1.92	33.53		0.0522	0000	21.91	200	1536.3	
		33.79	10.5	0.0515	2000.2	22.43	00.0	1534.4	80.0
C4UISF - 965 D4TE 17 FEB 65	STATICN SEA	2CNE -8	LATITUDE	DE 14 46.6 N 55 AFR	TEMP	I TUDE	120 12.6 E Temp instr rth	PARSCEN SAL IN	N SQUARE O
DEPTH DEV. 3. 1.03 15. 1.03 25. 1.03 55. 1.03	76 pp DEV. 20.3 0.02 26.1 0.02 25.3 0.02 25.3 25.3 0.03	SAL INITY 33.51 33.52 33.55 33.61	>0000 W • • • • E 0000	ELEC. COND. 0.0523 0.0522 0.0521	0.0000 0.0000 0.0000	516#A-1 21.84 21.88 21.92	.0000.000.0000000000000000000000000000	SOUND VEL. 1536.2 1536.2 1536.3	0.07 0.07 0.07
) () 	000	33.64	5 5	0.0518	0.0000		0.00	1535.3	0.07

	S I n Y S	996-	STA	STATION SEA	6	LATIT	9.9,		ITUDE	ш ;	MARSCE	JAR.	0 ;
_	OATE 17	7 FEG 65	TIME	/E 2000	1 - 3 - 2 - 8 - 2 - 8	DEPTH	55 AIR	TEMP 81.0		TEMP INSTR RT	H SAL	INSIK NAN	_ }
	_								10 x 4 a	7.0	COUNT VEL) EV	- }
	DEPTH	DEV.	<u>ا</u> م	מנע.	Ζ,	DEV.	ELEC, COND.	CEV.	21 CAP 1 C	00.00	٠ س	0.07	
	. . .	1. 0.1	~ r	200	• •	1000	0.0573	0000	21.88	00.0	1536.3	0.07	•
	• •	• ;	V 1	20.0	13.56	, 0	0.0523	00000	21.92	00.0	1536.4	20.0	
) (• • •	u a		, ,		0.0520	0.0000	22.06	00.0	.1535.6	0.07	
	, c) () (.	70.0	33.66	0.0	0.0518	0.000	22.18	00.0	1535.3	0.07	
!	50.	1.60	24.9	0.02	M	10.0	0.0514	000000	22.50	00.0	1534.1	0.08	
		370		STATION SEA	0	LATITU	ATITUDE 14 46.6 N		LCNGITUDE 120	12.6 E	MARSCEN	SQUARE	O
•	CAULSE 11	ן "	1 ×	210	ZCNE	DEPTH	-	R_TEMP_81.0	TEVP	EMP INSTR RTH	SAL	INSTR NAN	1_
•	i		1	:									1
								FEV	CICNA-I	DEV.	SOUND VEL-	DEV.	1
,	DEPTH	>	2. W.	~ (SALINITY) r.	0.0525	0000	21.79	00.0	٥.	0.07	
	٠.	٠,	9		22.51	1000	0.0522	0.000	21.88	00.0	1536.2	0.07	
	15.	3.0	26.0	0.02	33.55	0.0	0.0521	000000	21.96	0.00	1536.0	10.0	-
	10		8	0	_ 33.59 _	0.01	0.0519	00000	22.07	00.0	1535	200	
	35.	9	5.5	\circ	33.65	0.01	0.0518	0.0000	01.77	000	1536.2	0.08	1
ĺ	· • •	(-)	6.4	()	33.83	10.0	0.0514	0000.0	06.22		777.		
•	Courte	346	15	STATION SEA	4	LATIT	LATITUDE 14 46.6	א	LCNGITUDE 120	12.6 E	MARSCEN	SQUARE	
	1000	•								THETOTAL	TNCTR.	NAM NAM	٠,
	0ATE 17	7 FEB 65		TIME 2200	ZCNE =8	DEPTH	55 AI	R TEMP 80.0	LEFF	X SXI		- 1	. :
	. ~		:								1	7	i
٠	- 0.2 C	1150	dria	DEV.	SALTNITY	DEV.	ELEC. COND	· CEV.	SIGMA-I	OEV.	SUUNU VEL.	• • •	
	י ל		26.5	0.02	5	0.01	0.0525	0000.0	21.78	20.00	1230.0	50	1
			26.1	0.02	ഹ	0.01	0.0521	0.00.0	21.94	00.0	1555.4	200	
	25.	00	26.0	Č.02	ഹ	0.01	0.0521	0.000	21.97	000	1535.9	70.0	
		1.00	25.9	3.02	33.57	10.0	0.0520	0000	22.22		1534.9	0.07	
	35.	1.03	25.4	0.02	m :		10000	מבטנ	22.44	0.50	1534.4	0.08	1
	52	1.00	25.0	20.0	43.13	3	11000						

CHU1SF965	STATION SEA	•	LATITUDE	14 46.0 N	LCNGI	LCNGI TUDE 120 12.6	12.6 E	PARSCEN SOUARE	QUARE 0
DATE 17 FEH 65	11wE 2300	2CNE -8	DEPTH	55 AIR	1EMP 79.0	TENP	INSTR RTH	SAL INSTR	A NA N
Ξ.	** • •	1M1	NEV. E	e	CEV.		DEV.	نا	DEV.
	0.0	w.v.			00000000000000000000000000000000000000		000		0.07
30. 1.00 35. 1.00	25.9 0.02	33.58	5 5	0.0519	0.000	22.04	000	1535.7	0.07
	5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5		; ;;		0.0000		00.0		80.0
C2UISE 965	STATICK SEA	6 7	LATITUD	LATITUDE 14746.6 N		LENGITUEE 120	120 12.6 E	MARSCEN SQUARE	SQUARE 0
DATE 18 FEB 65	TIME 0000	20NE -8	оертн	55 AIR	TEWP 78.0	TEVP	INSTR RTH	H SAL INSTR	STR NAN
4 DEV	5 DEV	SALINITY	rev.	ELEC. COND.	CEV.	STGWA-T	DEV.	SCUND VEL.	DEV.
1.0	0.0	Ę,	0.01		0.000	21.81	00.0	1536.4	0.07
	0	m,	5	0.0521	0000.0	21.95	00.0	1535.9	0.07
ن ا) i	ή,	0.0	1750-0	00.00	21.96	00.0	5	20.0
35. 1.00	25.5 0.02	33.65	4 d 0 0 • • • • • •	0.0518	0.0000	22.17	20.0	1535.2	000
	0.0	m		0.0514	2000.0	22.48	00.0	1534.3	0.08
CRUISE 965	STATION SEA	4 4	LATITUG	LATITUDE 14 46.6 N		LOWGI TUDE 120	12.6 E	MARSCEN SQUARE	SQUARE 0
DATE 18 FES 65	TIME 0110	- 20NEB	CEPTH	55	R TEMP 78.0	TEMP	INSTR	TH SAL I	NSTR NAN
TH DEV	ł	SALTNITY		ю	. CEV.	STGMA-T	DEV.	SOUND VEL.	DEV.
0. 1.60	26.3 0.02	ų.	0.01	0.0524	00000	21.86	00.0	1536.2	0.07
0.1	6.1	~		0.0522	000000	21.95	00.0	1536.0	0.07
Ç• ₹	5.0	23.58		0.0521	0.000	21.99	00.0	1536.0	0.07
	8.	å		0.0519	0.000	22.08	0.00	1535.6	0.07
1.0	5.7	3.		0.0519	2000-0	22.14	00.00	1535.4	0.07
55. 1.5	5.0	33.82		0.0514	0000.0	22.48	00.0	1534.3	0.08

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ABI HI	o doi:	SALTNITY	DEV	ELEC. COND.	CEV.		DEV.	SOUND VEL.	DEV.
, er	26.2 0.02	33.52	00.0	0.0523	00		-0.01	1536.0	90.0
1.0	0 1.0	9	00.0	0.0522	1	ł	-0.01	1536-1	90.0
3. 1.0	0.0	33.56	00.0	0.0521			10.0-	1536.0	90.0
1.0	5.9	ď.	0.01	0.0520			00.00	1535.7	0.07
5. 1.0	5.6 0	ě	0.01	0.0518			00.0	1535.4	0.07
٠ <u>.</u> ر	5.3		10.7	0.0514	2000	}	00.0	1534.2	80.0
CAUISE 965	STATION SEA	4 4 9	LATITUDE	JE 14 46.6 N	LONGI TUBE	TUDE 120	12.6 E	MARSCEN	SQUARE
04FE 13 FEB 6	S TIME 0300	SCNE -8	DEPTH	SS AIR	AIR TEMP 75.0	TEMP	INSTR RTH	SAL	INSTR NAN
_									
1H 06V	C day	SALINITY	\ <u>></u>	CLEC. COND.	cev.	SIGMA-T	DEV.	SOUND VEL.	DEV.
00.1	26.2 0.02	33.52	0.0	0.0522	0.000	21.88	00.00	1536.0	0.0
	7.0	CC = C &	, c	0.0520	0000	22.03		1535.7	0.07
-		33.61	2	0.0519	000000	22.09	00.0	1535.5	0.07
0	2.0	33.64	0.01	0.0518	00.000	22.15	00.00	535.	0.07
	5.3	33.83	10.1	0.0514	2200.0	22.49	00.0	1534.3	8 0
CAUI SE965	STATION	SEA 4 9	LATITU	LATITUDE 14 46.6 N		LONGITUDE 120	12.6 E	MARSCEN	SQUARE
DATE 18 FER 6	55 TIME 0400	ZCNE -8	DEPTH	SS AIR	TEMP 75.0	TENP	INSTR RTH	H SAL INSTR	STR NAN
TH DEV	END DEV	SALINITY	DEV.	ELEC. COND.	CEV.	SIGNA-T	DEV.	SCUND VEL.	DEV.
1.0	6.2 0.0	33.52	0.0	0.0522	0.0000	21.88	00.0	0.0661	2000
1.3	6.1 5.0	33.56	c.01	0.0522	2000.0	21.95	000	1536.0	0.0
0.1	25.8 0.02	33.61	0.01	0.0519	00:00	22-17	00.00	1535.4	
30. 1.00	0.0	20.00	TO* 0	V-0014	2000	11.77) (1000	· ·
		004		0.0518	2000	22.17	ဝ	1535.3	

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DATE 1 - FE	6	1146 0530	6- 3VJZ	DEPTH	SS AIR	TEMP 75.0	TEMP	INSTR RTH	SAL INSTR	STR NAN
		, u	YT INT IN	, u	2		CTENA-T		CHIED VET	7.30
•		,		• -				•	,	
•		•				2				
:		ن • •	15.26	7		0.000			1536.1	0.0
			33.67	7:		0.0°0°			1535.7	20.0
-	,	0.0	33.64	 -		00.0.0			1535.4	0.07
		0	33.56	7.		0,000			1535.3	0.07
1		55.1 5.62	13.83	[::	0.0516	2000.0	22.44	00.0	1534.4	0.07
CRUISE -	965	STATION SEA	4 4	LAIIIU	LAIIIUUE 14 46.6 N	LONGI	LONGI TUDE 120	12.6 E	MARSCEN SQUARE	SQUARE 0
DATE 18 68	ď	TIME OACG	A. PATA	DEPTH	84 410	75.00 75.0	TEND	TTO STORY	2	247
		2	>+ 10.1 T				1		TEAL VIEW	2
r	• ;	יים א איים היים	22 S.C.	• • • •	סני	•	_			
• •	. .		33.55	100	6630		7 7		1535.9	200
•	3 :) C	֓֝֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓		0.000		~		1525 4	
•) ·		, 4		0.010	0000	·	00.0	1535.2	
•	,			· -	0.0518	0.00.0		00.0	1525.5	
30.1	18	24.9 0.02	2 10 10 10 10 10 10 10 10 10 10 10 10 10	10.	0.0514	0.0400	25	2.00	1534.0	0.08
RUISE	- 965	STATICN SE	EA 4 9	LATITUDE	JDE 14 46.6 N		LONGI TUDE 120	3 12.6 E	MARSCEN	SQUARE
ATE 18 FE	E6 65	TIME 0750	35. 3N2.	0EPTH	55 AIR	TEMP 76.0	TEN	P INSTR RT	H SAL 1	NSTR NAN
•				,						
) H		END DEV	SALINITY	DEV.	١.	- 1	SIGMA-T	<u>></u>	ND VEL	. DEV.
	3	6.2 6.0	33.55	C•C1	S	0.000	21.92	•	1535.9	0.07
5. 1	2,	6.2 0.0	33.56	0.01	S	00000	21.92		1536.2	10.0
25. 1.5	13	26.1 0.02	33.58	0.01	0.0522	000000	21.95	00.00	1536.2	0.07
	00	5.7 0.0	33.64	0.01	5	0000.5	22.12		1535.5	0.01
	ر د د	6.0	33.69		3	0000	10 00		. 1525	,
				7	`	20.0	17.77	•	7.6661	

ARSCEN SQUARE C	EL. DEV	NSTR 00.0000000000000000000000000000000000
12.6 E MARSO INSTRATH SAU	DEV. SQUND VE 0.00 1535.9 0.00 1536.2 5.00 1535.3 0.00 1535.7 0.00 1535.3	.6 E FARSCE STR RTH SAL V. SQUND VEL 1536.2 01 1536.3 01 1535.8 01 1535.8 01 1535.8
LCAGITUDE 12C	S1GRA-T 21.92 21.92 21.94 21.94 22.07 22.07	S2.0 TEMP 1 S1.0 TEMP 1 S1.00 TEMP 1 S1.90 -0 21.90 -0 21.91 -0 21.91 -0 22.05 -0 22
14 46.6 N 55 ATR TEMP	ELEC. CGND. LEV. 0.0522 0.0700 0.0523 0.0000 0.0522 0.0000 0.0520 0.0000 0.0520 0.0000	14 46.6 N L LEC. CGND. CEV. 0.0523 0.0000 0.0523 0.0000 0.0520 0.0000 0.0519 0.0000 0.0519 0.0000 0.0514 0.0000
9 LATITUDE ER DEPTH	55 C.01 56 C.01 57 C.01 57 C.01 58 C.01 58 C.01	-8 DE-IN- 5 -30 -20 -20 -20 -20 -20 -20 -20 -20 -20 -2
ICN SEA 4 093C ZCNE	0EV. SALTNI 0.02 33.9 0.02 33.5 0.02 33.5 0.02 33.6	10% SEA 4 093C ZENE 69.09 93.00 93.0
FER 65 TIVE	26.2 26.2 26.2 26.2 26.1 20.2 25.3 25.3	FF. 65 HIPP OF 25.2 5.12 5.12 5.12 5.12 5.12 5.12 5.12
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THE LET SEVEN DEV. SALVANIA FEV. ELEC. 2000. 21:93 -6.01 1556.1 0.006 21:92 -6.02 33.55 0.00 0.0523 0.0000 21:93 -6.01 1556.2 0.006 22:03 26:03 0.02 33.56 0.00 0.0523 0.0000 21:93 -6.01 1556.2 0.006 23:04 0.02 33.56 0.00 0.0523 0.0000 21:94 -0.01 1556.2 0.006 23:05 0.02 33.56 0.00 0.0523 0.0000 21:94 -0.01 1556.2 0.006 23:05 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.2 0.006 23:05 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.2 0.006 24:15 0.02 26:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.2 0.006 24:15 0.02 26:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.2 0.006 25:03 0.02 26:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.2 0.006 25:03 0.02 26:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.3 0.006 25:03 0.02 26:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.3 0.006 25:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.3 0.006 25:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.3 0.006 25:03 0.02 33.56 0.00 0.0523 0.0000 22:04 -0.01 1556.3 0.006 25:03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.	-	>1C				1	,	l	>	j,
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10.0 20.1 10.0		200		.) (6000				2 2	, C
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100 26.75 100 10	•) () () (י י	• (2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7) () (0.4		536.	9 0
1965 3717101 SEA 4 9 LATITUDE 14 46.6 N LCNGITUDE 120 12.6 E WARSDEN SOUBR SEE 55 TIVE 1140 ZCNE -8 DEPTH 55 AIR TEMP 86.0 TEVP INSTR RTH SAL INSTR	• • •	7.0		• ()	6150		7		535.	9
- 965 STATION SEA 4 9 LATITUCE 14 46.6 N LENGITUCE 120 12.6 E MARSCEN SQUAR 1 FET 65 TIVE 1140 ZCNE -9 DEPTH 55 AIR TEMP 86.0 TEMP 1NSTR RTH SAL INSTR CO. SC. SC. SC. SC. SC. SC. SC. SC. SC. SC		0.0	(6) (6)	•	.0514	J C O	54	13.	534.	0
### 14 FEF 65 TIVE 1140 ZCNE -9 DEPTH 55 AIR TEMP 86.0 TEVP 1NSTR RTH SAL INSTRACT 1.50	97	ION SE	4	LAFITE	14 46.6	9437	120 1	\$	ARSCEN	
### 150	47E 14 FEE 6	1 0 1 1	्। - ध	C.	5 AIR	.98 dw	Id^3	α α	SAL	STR NAN
15. 1.5. 24.2 3.0.2 33.54 0.0.0523 0.0.0.0 21.94 0.0.1 1536.1 0.0.0 20.0 20.0 20.0 20.0 20.0 20.0 2				į	,					
1.00 25.1 3.02 33.56 0.00 0.0523 0.000 0.0194 -0.01 1536.3 0.00 0.00 0.00 0.00 0.00 0.00 0.00	243 . KE 14	7 0 EV	ALINI	> : w	υ. Ο) (E	- V	• • > •	CUND	> 0
25.7 2.0.2 33.59 0.00 0.0523 0.00 0.00 1.594 0.00 1.596.3 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0) (0.0	^ .	٠ د	200		, D (3.0	•	2
25.1 2.02 23.53 C.CC 0.0512 0.0700 21.96 -0.01 1536.3 0.006 1.00 25.7 0.02 23.53 C.CC 0.0519 0.0700 22.54 -0.01 1535.6 0.066 1.00 24.9 0.02 33.84 0.00 0.0514 0.0700 22.54 -0.01 1535.6 0.066 1.00 24.9 0.02 33.86 0.000 14.46.6 N LCNSITUDE 120 12.9 E MARSCEN SQUARE 2 FEb 65 TIME 1600 2CNE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTRATH SAL INSTRANA SQUARE 1.00 26.5 0.000 21.81 -0.01 1536.6 0.05 1.00 26.5 0.000 21.82 -0.01 1536.4 0.00 1536.4 0.006 21.00 -0.01 1536.4 0.006 1.00 25.2 0.00 2 23.54 0.00 0.0522 0.0000 21.91 -0.01 1536.4 0.006 1.00 25.2 0.00 2 23.54 0.00 0.0522 0.0000 21.91 -0.01 1536.4 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 25.2 0.000 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 1.00 21.91 -0.01 1536.5 0.006 21.91 -0.01 1536.5		0.0		. c	200.		7 6	7.5	•	Э С
1.05 25.7 0.02 33.84 0.0514 0.07 0.0515 0.056) (• • •			<u>،</u> د	7.50) C	1 V C		•) C
1.00 24.9 5.02 33.96 0.00 0.0514 0.0°C0 22.54 -3.01 1534.1 0.00 0.05 0.0°C0 22.54 -3.01 1534.1 0.00 0.05 0.0°C0 22.54 -3.01 1534.1 0.00 0.05 0.0°C0 22.54 -3.01 1534.1 0.00 0.00 0.0°C0 21.81 -3.01 1536.4 0.00 0.00 0.0°C0 21.81 -3.01 1536.4 0.00 0.0°C0 21.81 -3.01 1536.4 0.00 0.0°C0 21.81 -3.01 1536.4 0.00 0.0°C0 21.89 -3.01 1536.4 0.0°C0 0.0°C0 21.89 -3.01 1536.5	• • •	2.7) (.051	000	2			ပ
2 FED 65 TIME 16CO 2CNE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTRACT. SAL INSTRANDAL. 1.00 26.5 D.C. 33.54 G.C. 0.0526 0.0000 21.81 -0.01 1536.6 0.006 1.00 26.2 0.00 21.82 -0.01 1536.6 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.00 21.83 -0.01 1536.4 0.006 1.00 26.2 0.006 21.83 -0.01 1536.4 0.006 1.00 26.2 0.006 21.83 -0.01 1536.4 0.006 1.00 26.2 0.006 21.83 -0.01 1536.5 0.006 1.00 26.2 0.006 21.93 -0.01 1536.5 0.006 1.00 26.2 0.006 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1536.5 0.006 1.00 21.93 -0.01 1.00 20 20 20 20 20 20 20 20 20 20 20 20 2	3.1	0.0_6.4		0	.051	0,0	3,7	.61	34	O
2 FED 65 TIME 16CO 2CNE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTRARH SAL INSTRANA 100 LEV. TEMP DEV. SALINITY DEV. ELEC. COND. DEV. SIGNA-T DEV. SGUND VEL. DEV. 1.00 26.5 0.00 21.81 -0.01 1536.6 0.06 1.00 26.5 0.00 21.82 -0.01 1536.6 0.06 1.00 26.5 0.00 21.82 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 21.81 -0.01 1536.4 0.06 1.00 26.5 0.00 27.5										
JTE 18 FEB 65 TIME 1650 ZCNE -8 DEPTH 43 AIR TEMP 82.0 TEMP INSTRATH SAL INSTRANA 	24-	Z O	*	LATIT	14.46.6	LCNS	12C	6.	MARSCEN	SQUARE
UEV. TEMP DEV. SALINITY DEV. ELEC. GOND. DEV. SIGMA-T DEV. SCUND VEL. DEV.	are 18 Feb 6	4E 16	CAE	T SEPTH	43 AI	EMP 82	I dw31	NSTR RT	SAL	!
LATH DEV. TEMP DEV. SALINITY DEV. ELEC. GOND. DEV. SIGMA-T DEV. SCUND VEL. DE 0. 1.00 26.5 0.02 33.54 0.00 0.0526 0.0000 21.81 -0.01 1536.6 0. 0. 1.00 26.4 0.02 33.54 0.00 0.0525 0.0000 21.82 -0.01 1536.4 0. 2. 1.00 26.2 0.02 33.54 0.00 0.0523 0.0700 21.89 -0.01 1536.4 0. 3. 1.00 26.2 0.02 33.54 0.00 0.0522 0.0000 21.91 -0.01 1536.4 0. 3. 1.00 26.2 0.02 23.54 0.00 0.0522 0.0000 21.91 -0.01 1536.4 0. 3. 1.00 26.2 0.02 23.54 0.00 0.0522 0.0000 21.91 -0.01 1536.5 0.		·		a a		!		<u>!</u> :		
U. 1.00 26.5 3.02 33.54 6.00 0.0526 0.0000 21.81 -0.01 1536.6 0. 10. 1.60 26.4 0.02 33.54 0.00 0.0525 0.0000 21.82 -0.01 1536.7 0. 25. 1.00 26.2 0.00 33.54 0.00 0.052 0.000 21.91 -0.01 1536.4 0. 35. 1.00 26.2 0.00 21.91 -0.01 1536.4 0. 35. 1.00 26.2 0.00 21.91 -0.01 1536.4 0. 35. 1.00 26.2 0.000 21.91 -0.01 1536.5 0.	LATHT DEV	NP DEV	ALI	S		2	Y-A-	EV.	V OND	ıw
1.60 26.4 0.02 33.54 6.00 0.0523 0.0000 21.82 -0.01 1536.4 0. 3. 1.00 26.2 0.0523 0.0700 21.89 -0.01 1536.4 0. 3. 1.00 26.2 0.052 0.0000 21.91 -0.01 1536.4 0. 5. 1.00 26.2 33.54 0.00 0.052 0.000 21.91 -0.01 1536.5 0.	0.1 .0	.5 3.0	ě	٠	.052	6	81 -	.01	536	•
5. 1.C. 26.2 5.02 33.54 5.00 0.0523 5.0703 21.89 -5.01 1536.4 5. 5. 1.C. 26.2 5.02 33.54 5.00 0.0522 5.0005 21.91 -0.01 1536.4 0. 5. 1.C. 26.2 3.02 33.54 5.00 0.0522 0.0005 21.91 -0.01 1536.5 0.	0 - 1 - 0	0.0 4.	å	٠	.052	S	- 28	.01	36	•
5. 1.00 25.2 3.02 33.54 0.00 0.0522 0.000 21.91 -0.01 1536.4 0.	0.4	2.0	'n.	ر. د	.052	င်း	600	.01	36	•
5. 1.02 25.2 3.32 3.54 0.00 0.0522 0.00 0.01 1.535.5 0.	7.1	2.0	'n.	٠,	052	င်း	16.	.01	36	•
	٠٠. ٠٢	C C	,	(

DATE 18	8 FEB 65	TIPE 1700	2CHE -8	DEPTH	43 41K	TEMP 82.0	TEMP 1	INSTR RTH	SAL INSTR	TR NAN
		:				:	:			
DE2TH	CEV.	75.4 DEV.	SACINITY	DEV.	ELEC. COND.	CEV.	STCHA-T D	DEV.		DEV.
	20.1	6.4 0.0	33.52	00.0	i	00000		-0.01	1536.6	90.0
?;	00.1	6.3	33.53	000		0000		.0.		90.0
	000	0.0	13.53	000		0000			1536.5	000
.5	26-1	6.1 3.0	33.54	00.0		0.000	Į.	-0.01		90.0
37.7	- 165	STATION SEA	4 10	LATITUDE	DE 14 46.6 N	LCNG	LCNGITUDE 120	12.9 E	MARSCEN	SOUARE
	49 rug	TIVE 1900	2CNE -8	DEPTH	43 AIR	TEMP 83.0	TEMP	INSTR RTH	H SAL IN	INSTR NAN
-										
	30	0EV	SALINITY	DEV.	ELEC. COND.	CEV	A-T	UEV.	SOUND VEL.	DEV.
,	; (0.0	20.05) C	- 1		ο α α	1000	1536.7	000
22.	1 - 1 1 - 1 1 - 1 1 - 1	. 4.	33.52			0000	21.82 -(10.0	536	90.0
O		6.2 0.3	33.52	J	1	0.0000	68	5.01	1536.4	92.0
5	Ç	0.2 C.C	33.52	C		2020.0	89	0.01	1536.5	90.0
')	3	0.0	33,54	၁ ()	l	00.00.0	21.93 -(0.01	1536.4	90*0
CKUTSE	965	STATION SEA 4	14 10	LATITE	LATITUDE 14 46.6 N	רסאכ	LONGITUDE 120	12.9 E	MARSCEN	SQUARE
-		TIME 1	N E	ОЕРТН		TEMP_	·-	STR	İ	STR
	i 1 !	* * * * * * * * * * * * * * * * * * *								
: 	D c	EMP DEV	INITY	DEV.	ELEC. COND.	CEV.	-	DEV.	SOUND VEL.	DEV.
, ,	٠,		2. 57	200	0.000	2000		10.0	1536 6	
20°).)) ()	26.2 0.02	, m	000	0.0523	0000	ሳው	10.01	1536.4	90.0
113	0	6.2 6.6	3.53	20.0	0.0522	0.0000		0.01	1536.4	90.0
'n	7	0.0 0.0	3.55	00.0	0.0521	00000	~	-0.01	1536.2	90.0
1	í									

ことの主義の関連を行っていますが、 日本のは関係の関係の対象を行う思いました。 あっぱななりに対している。

CRUISE965 DATE 18 FEB 65	STATION SEA	A 10	LATITUDE	14 46.6 N	LONGITUDE	TEMP INST	INSTR RTH	SAL I	INSTR NAN
.	3	> 1 N					JEW.	 -	OEV.
() 	20.4 0.02	3.5	00		0,000		10.0	5 5	90.0
	4.9	33,51	!		00000	i	10.0	1536.7	0.00
0.1	5.9	•			0.000		0.01	1536.3	90.0
0.1	0.9	۳,	į		0.0000	1	10.0	1536.0	90.0
	5.8	Ä			0000.0		0.01	1535.8	90.0
3.1	5.5	Ť			0.0000	i	0.01	1535.3	90.0
C <uise 965<="" td=""><td>STATION SEA</td><td>A 4 10</td><td>LATITUDE</td><td>DE 14 46.6 N</td><td>רטעטן</td><td>LCNGITUDE 120</td><td>12.9 E</td><td>MARSCEN</td><td>SQUARE</td></uise>	STATION SEA	A 4 10	LATITUDE	DE 14 46.6 N	רטעטן	LCNGITUDE 120	12.9 E	MARSCEN	SQUARE
4TE 13 FES 65	71ME 2100	2CNE -8	DEPTH	43 AIR	TEMP 80.0	TEMP	INSTR RT	H SAL	INSTR NAN
(L)	END	SALINITY	DEV.	ELEC. COND.	CEV.	1	DEV.	SOUND VEL.	DEV.
1.0	4.9	33.51	00.0	0.0524	0000*0		-0.01	1536.4	90.0
5.1	4.9	33.51	03.3	0.0524	0.000	1	-0.01	1536.6	90.0
3. 1.0	ر)	33.54	00.0	0.0521	0.000	7.4	-0.01	1536.0	90.0
. Tu	25.9 0.02	33.59	00°0	0.0520	0000.0	22.03	-0-01	1535.8	90.0
7.0		33.01	00.00	0.0019	20.00	2	10.01	1232.0	95.0
. .	5.5	33.66	၁၀•၁	0.0518	0000.0	22.19	-0-01	1535.2	90.0
CAUISE 965	STATION SEA	A 4 10	LATITUDE	JE 14 46.6 N	LONGI	LCNSITUDE 120	12.9 E	MARSCEN	SOUARE
DATE 18 FEB 65	TIME 2200	SCNE -8	DEP TH	43 AIR	1EMP 79.0	TEMP	INSTR RTH	SAL	INSTR NAN
_									
12	FPP	SALINITY	DEV.	ELEC. COND.	CEV.	L.	DEV.	SOUND VEL.	DEV.
1:0	4.9	33.51	00.0	0.0524	0.00.0		-0.01	1536.4	90.0
1.0	6.1	33.54	00.0	0.0522	0.000	1	0.01	1535.9	90.0
. 1.C	6.9	33.56	00.0	0.0520	0.000		-0.01	1535.7	90.0
0.1	2.4	33.68	00.1	0.0517	0.000	1	-0.01	1534.8	90.0
	25.1 0.02	33.76	00.0	0.0515	000000	22.38	-0.01	1534,4	0.06
	5.0	33.79	00.0	0.0514	0.00.0	ì	-0.01	1534.1	90.0

O			0				1
SQUARE	SAL INSTR NAN	0.06 0.06 0.06 0.06 0.06	SQUARE ISTR NAN	0.06	90.0 0.0	90.0	92.0
MARSDEN SQUARE		SGUND VEL- 1536.1 1536.1 1536.0 1535.7 1535.4	PARSCEN SQUARE SAL INSTR N SQUND VEL. DEV.	1536.3	1536.5	1535.7	1535.3
LCNGITUDE 120 12.9 E	TEMP INSTR RTH	21.83 -0.01 21.91 -0.01 21.94 -0.01 22.04 -0.01 22.14 -0.01 22.21 -0.01	LONGITUDE 120 12.9 E 77.0 TEMP INSTR RTH SIGMA-T DEV.		21.92 -0.01	22.06 -0.01 22.03 -0.01	22.18 -0.01
LCNGI	43 AIR TEMP 78.0	C. 0700 0.0700 0.0700 0.0700 0.0700	6 N LONGITAIR TEMP 77.0	,		0.0000	0.9566
LATITUDE 14 46.6 N	43 ATR	ELEC. COND. 0.0524 0.0521 0.0521 0.0520 0.0519	LATITUBE 14 46.6 N DEPTH 43 AIR	_	1	0.0520	•
LATITU	ОЕРТН	DEV. C. CC. C. CO. C. CO. C. CO. C. CO.	LATITUC DEPTH DEV		80.0		20:0
4 10	2CNE -A	5ALTNITY 33.54 33.55 33.55 33.56 33.64	4 10 2CNE -9	33.53	33.51	33.60	33.68
STATICH SEA	TIME 23C0	TEMP DEV. 26.4 0.02 26.2 0.02 26.1 0.02 25.4 0.02 25.7 0.02 25.5 0.02	STATION SEA TIME 00C0		26.4 5.02	25.3 0.02	29.6 9.52
CAUISE 965	DATE 18 FER 65	- DEPTH DEV. 11. 1.00 20. 1.00 30. 1.00 35. 1.00	CAUTSE 365 DATE 19 FEB 65	0.1.00	10. 20. 1.00	•	45. 1.55

	Z	1						,
SOUARE	INSTR	DEV.						
PARSCEN	SAL II	SOUND VELL	1536.3	1536.4	1536.2	1535.8	1535.5	1535.4
	<u>=</u>							
12.9	INSTR	DEV.	-2.01	-0.01	-0.01	-0.01	-3.01	10.01
LCNGTTUDE 120 12.9 E	1649	SICHA-T						
CNCI	76.0	ĺ						
ı [—]	TEMP	CEV.	0.00	0.0.0	0.00	0.000	0:0:0	C. GC0
14 46.6 N	43 AIR	COND.	*2	24	22	ည	61	E1
E 14 4	\$	FLEC. COND.	0.05	0.05	0.05	0.05	0.05	0.05
LATITUDE	DEPTH	, EV.	30.3);·:)	00.	00.	٠, ١	5.5C
9	Œ	117	53	.53	. 54	59	63	\$9.
01 +	ZCNF	SAL IN I TY	33,	33	33	33,	33,	33
STATION SEA	TIME DICC	UEV.	6.32	2.02	20.0	0.02	2.05	20.0
ST	11	TEVP	26.3	26.3	26.2	25.9	12.5	55.6
-365	ATE 19 FEB 65	OEV.	1.35	1.20	1.30	ì • · 3 C	1.0.	1.30
CRUISE	DATE 19	DEPTH	;	13.	, 0,	35.	35.	, ; ,

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1								
	C_dai	SALINITY	2	. conc.	ш	VA-T	SCUND VEL.	DEV.
	6.3 3	3.5	00.0	3524	o	.85 -0.0	1536.3	92.0
	6.3	3.5	9	. 255	O	3.0- 38.	1536.4	93.0
	0.20	3.5	ر ۲	0522	o	06.	1536.3	90.0
	6.1 0	3.5	3	2750	\mathbf{c}	0 76.	1536.2	90.0
	25.9 0.02	33.59	000	520	0.000		1535.9	90.0
	9.5	3.6	၁၀ • ပ	C518	0	0- 91.	1535.4	93.0
	-STATION-SEA	01 7	LATITUE	N 9.05 18 30	L CNG14JPE	3 6.21 001 3dur.	MARSCEN	SQUARE 0
65	TIME 0300 -	ZONE -3	n1 e30	AIR AIR	1EMP 75.0	TEMP INSTRURTH	SAL	INSTR NAN
		,	;	:				
1	ENP DEV	SALINITY	CEV.		CEV.	DE T-KO		SEV.
	6.3 0.0	3.5	000	352	0.0000	85 -0		6.36
		י נית		752	0000	000		() () () (
	2.0	, L.	0	7 6	0000	100	3.00	
	ò		000	0.0521	00000	00 -0.	1536.1	7 4 0
J	5.8 5.0	13.61	00.5	רי	6.000	90.		90°0
	STATICS	4	4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	47 71		A 0 1 001 3011	S S S S S S S S S S S S S S S S S S S	0 300100
	,	•		7			N N N N N N N N N N N N N N N N N N N	u
65	TIME 0400	2CNE -B	DEPTH	43 AIR	TEMP 0.0	TEMP INSTR R	TH SAL I	NSTR NAN
- 1			- 1				ľ	
	END DEV	2,	··	COND	CEV.	1 - V	SOUND VEL.	DEV.
	5.0	ή.	•	224	00.000	9	1536.2	90.0
	6.2 5.0	~· ,	•	523	00000	6	1536.2	90.0
	0.0	'n,	•	522	00000	66	1536.1	90.0
	25.7 0.02	33.62	00 00 00	0.0519	00:00	22.11 -0.01	1535.4	90.0
	2	٠.	•	218	0.0	_	1535.2	0.00

Cauras	59	STATION	SEA	4 10	LATITUDE	UE 14 46.6 N	LONGI TUDE	120	12.9 €	MARSCEN	SQUARE
10 12 14 14 15 14 15 15 15 15 15 15 15 15 15 15 15 15 15		TIME 050	200.	ZCNE -8	DEPTH-	43 AIR	TEMP 0.0	TEVP	EMP_INSTR'RTH	SAL	INSTR NAN
:	1		1		1						
1		Azi Sa		2	TEV	FLEC. COND.	CEV	SICHA-T	DEV.	SOUND VEL.	DEV.
 L			,	. 75	00	,	00.00	88		1536.1	90.0
• • • • • • • • • • • • • • • • • • • •) F	1	. 75	00.0	0.0523	00000		10.0	1536.2	90.0
* * * * * * * * * * * * * * * * * * * *) ()) ()		. 2.	00.0	0.0520	0.000	10.	•	1535.7	90.0
) () () () () () () () () () (1	4	00.0	0.0518	0.0000	20	0.01	1535.1	90.0
•		, 6,			00.0	0.0517	000000		-0.01	1534.8	90.0
		25.1		7.9	1.00	0.0515	00000	040	0.01	1534.5	90.0
CAUISE 3	965	STATION	SEA	4 10	LATITUDE	JDE 14 46.6 N		LONGITUDE 120	12.9 E	MARSCEN	SQUARE
9 FE	. 59 8	11 ME 06	2290	2CNE -8	OEP TH	43 AIR	TEMP 0.0	TEMP	INSTR RTH	SAL	INSTR NAN
-											
DEATH DEV		DEV		SALINITY	DEV.	ELEC. COND.	CEV.	1:	DEV.	SOUND VEL.	0EV.
0.1 .0	٠.,	6.2 0.0	•	33.55	00.0	0.0523	0.000	١,	10.0	0.0661	00.0
0. 1.0	·	6.2 3.0	\ \ \ \ \ \	33.54	00.0	0.0523	2000°0	2 4	100	1536.0	0.0
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APPENDIX B

Core Analysis Summary Sheets

- Engineering Properties
 Sediment Size and Composition

1. EXPLANATION OF DATA PAGES CORE ANALYSIS SUMMARY SHEET Engineering Properties

Results of engineering properties, core analysis performed by the U.S. Naval Oceanographic Office Geological Laboratory are recorded on Core Analysis Summary Sheet Engineering Properties.

The following is a description of the terms employed on the Core Analysis Summary Sheet:

- 1. <u>Cruise Number</u>. A number assigned to each cruise for identification purposes.
 - 2. Latitude. Expressed in degrees, minutes, and seconds.
 - 3. Longitude. Expressed in degrees, minutes, and seconds.
- 4. <u>Sample Number</u>. A consecutive number, commencing with 1, applied to each core taken successively throughout the cruise.
 - 5. Date Taken. Day (GMT), month, and year.
 - 6. Water Depth (m). The uncorrected sonic sounding recorded in meters.
 - 7. Type Corer. Identified by the name of device employed.
 - 8. Core Length(cm). Recorded in centimeters as observed in the laboratory.
 - 9. Core Penetration (cm). Recorded in centimeters as observed in the field.
- 10. Subsample Depth in Core (cm). Interval of subsample as measured in centimeters from the top of the core.
- 11. Wet Unit Weight (g/cm^3) . The weight (solids plus water) per unit volume of the sediment mass.
- 12. Specific Gravity of Solids. The ratio of weight in air of a given volume of a sediment at 20°C to the weight in air of an equal volume of distilled water at 20°C.
- 13. Water Content (% dry weight). The ratio, in percent, of the weight of water in a given mass of the sediment sample to the weight of the solid particles.

- 14. Void Ratio. The ratio of the volume of void spaces to the volume of solid particles in the sediment sample as computed from Wet Unit Weight, Specific Gravity of Solids, and Water Content.
- 15. Saturated Void Ratio. The Void Ratio at 100 percent saturation as computed from Water Content and Specific Gravity of Solids.

Saturated Void Ratio = Water Content X Specific Gravity of Solids

- 16. Porosity (σ_0) . The ratio, usually expressed as a percentage, of the volume of voids of a sediment mass to the total volume of the sediment mass.
- 17. <u>Liquid Limit</u>. Water Content, in percent, at which a pat of sediment cut by a groove of standard dimension will flow together for a distance of 1/2 inch under the impact of 25 blows in a standard liquid limit apparatus.
- 18. Plastic Limit. Water Content, in percent, at which a sediment will just begin to crumble when rolled into a thread approximately 1/8 inch in diameter.
- 19. Plasticity Index. The numerical difference between the Liquid Limit and Plastic Limit of the sediment mass.
- 20. Liquidity Index. The ratio, expressed in percentage, of (1) the natural water content of the sediment sample minus its Plastic Limit to (2) its Plasticity Index.
- 21. Compression Index. The slope of the linear portion of the Pressure-Void Ratio curve on a semi-log plot.
- 22. Compressive Strength. The load per unit area required to shear an unconfined, natural or remolded, sediment mass.
- 23. Cohesion. The shearing strength per unit area under zero externally applied load.
- 24. Sensitivity. The ratio of the natural to the remolded strength. It is a measure of the loss of strength due to remolding the sediment mass.
- 25. Angle of Internal Friction (°). The angle between the abscissa and the tangent of the curve representing the relationship of "shearing resistance" to "normal stress" acting within a sediment mass.
- 26. Activity. The ratio of the Plasticity Index to the clay fraction percentage (K.002 mm) of the sediment mass.

- 27. Modulus of Elasticity. The ratio of stress to strain of the sediment mass.
- 28. Slump $(\frac{\sigma_0}{\epsilon})$. The ratio, in percent, of the amount of height change immediately before the compressive strength test to the original height of a cylinder of sediment.

CORE ANALYSIS SUMMARY SHEET

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28. SLUMP (\$)	- 63	1.63	90	2.17

28. REMARKS NO FREE WATER, KAUS IN CORE. NOHEROUS SHALLS COULD BE HEAD CHANNED AS SANDLING INTENDED INTO CORE DEDINANT IS DESIGNED EXCEPT NEW NEW RETION AT 10P. SEDIMENT IS BURCK IN CALIBET WITH CARE TRAPPEL. CORE CORE & 16 & 16 & 20 CM.

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CORE ANALYSIS SUMMARY SHEET ENGINEERING PROPERTIES

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23. COMESION NATURAL (g/cm2)	35.18	8	15.38		21.88		48.16	9	88.09	+
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24. SENSITIVITY	4.01				2.90		+	1	4.16	+
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28. SLUMP (%)			2.68				2.17			

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2. EXPLANATION OF COMPUTER DATA SHEET SEDIMENT SIZE AND COMPOSITION

Results of sediment-size and -composition core analysis performed by the U.S. Naval Oceanographic Office Geological Laboratory are tabulated on Computer Data Sheet Sediment Size and Composition.

The following is an explanation of the terms employed on the Computer Data Sheet:

- 1. CRUISE. A number assigned to each cruise for identification purposes.
- 2. SAMPLE. A consecutive number applied to each core taken successively throughout the cruise.
- 3. LATITUDE. Expressed in degrees, minutes, and tenths of minutes.
- 4. LONGITUDE. Expressed in degrees, minutes, and tenths of minutes.
- 5. TAKEN. Date in month, day, and year that core was taken.
- 6. CORER TYPE. Number corresponding to sampling device code below.
 - 1. Hydroplastic piston
- 6. Orange Peel
- 2. Hydroplastic gravity
- 7. Ewing
- 3. Kullenberg piston
- 8. Vibrocorer
- 4. Kullenberg gravity
- 9. Dredge
- 5. Phleger gravity
- 0. Other
- 7. LENGTH. Length of core recorded in centimeters as observed in the laboratory.
- 8. PENETRATION. Penetration of coring device recorded in centimeters as observed in the field
- 9. DEPTH. The uncorrected sonic sounding recorded in meters.
- 10. ANALYZED. Date in month, day, and year that core was analyzed in the laboratory.
- 11. ID. NO. Three digit laboratory project number followed by consecutive number assigned to each subsample analyzed.
- 12. INTERVAL. Interval of subsample as measured in centimeters from the top of the core.

- 13. MM. Particle diameter size intervals based on Wentworth size grades in millimeters.
- 14. PER. Percent of total sample weight within the given size interval.
- 15. GRAVEL, SAND, SILT, CLAY. Percent of total sample weight within the four size classes.

Class ranges are: Gravel - coarser than 2 mm
Sand - 2 to 0.0625 mm
Silt - 0.0625 to 0.0039 mm
Clay - finer than 0.0039 mm

- 16. MEAN (MM). The geometric mean of the distribution expressed in millimeters.
- 17. MEAN (PHI). The logarithmic mean of the distribution expressed in phi units (-log2 of the diameter in millimeters).
- 18. STAN DEV. Standard deviation. A measure of the degree of spread or dispersion of the distribution about the mean expressed in phi units.

$$\sigma = \sqrt{\sum f(X_i - \overline{X})^2 / 100}$$

19. SKEWNESS. A measure of the asymmetry of the distribution. Positive values denote skewness of the distribution toward the fine particles, negative values denote skewness toward the coarse particles. A normal distribution has a skewness of 0.

$$\alpha_3 = \frac{1}{100} \sigma^{-3} \sum f(X_i - \overline{X})^3$$

20. KURTOSIS. A measure of the peakedness of the distribution. Positive values denote a "leptokurtic" distribution, or a distribution more "peaked" than normal. Negative values denote a "platykurtic" distribution, or a distribution more "flat" than normal. A normal curve has a kurtosis of 0.

$$\alpha_4 = \frac{1}{100} \sigma^{-4} \sum_i f(X_i - \overline{X})^4 - 3$$

- 21. CACO3. Percent calcium carbonate of the total sample weight as determined by the insoluble residue method.
- 22. ORG CARBON. Percent organic carbon of the total sample weight as determined by the Allison method.



- 23. COLOR. Wet sediment color, based on the Geological Society of America Rock-Color Chart, as determined in the laboratory.
- 24. DOM MINERAL. Dominant mineral (s) comprising the sample assemblage.
- 25. SEC MINERAL. Secondary mineral (s) comprising the sample assemblage.

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ORIGINATING ACTIVITY (Corporate author)

28. REPORT SECURITY CLASSIFICATION

Unclassified

U.S. NAVAL OCEANOGRAPHIC OFFICE

D-A090010

REPORT TITLE

ENVIRONMENTAL DATA REPORT, SUBIC BAY, REPUBLIC OF THE PHILIPPINES, JANUARY AND FEBRUARY 1965

DESCRIPILIVE-NOTES (Type of report and inclusive dates)

Informal Reports 22 Januar 22 January and 17 to 19 February 1965

DALE E. KENNEY

REPORT DATE Apr 1970

41

CONTRACT OR GRANT NO

98. ORIGINATOR'S REPORT NUMBER(\$)

14) NOO TR-19 IR No. 70-14

b. PROJECT NO 102-01

9b. OTHER REPORT NO(5) (Any other numbers that may be assigned this report)

U.S. Naval Oceanographic Office

The U.S. Naval Oceanographic Office (NAVOCEANO) conducted a limited environmental survey in Subic Bay, Republic of the Philippines, in January and February 1965. The purpose of the survey was to measure oceanographic environmental parameters in support of NAVOCEANO's mine warfare program. Temperature and salinity measurements and bottom sediment samples were obtained at 10 stations. Two of these stations were time-series anchor stations with current measurements and ambient noise recordings.

The influence of tidal currents are thought to be responsible for the fluctuation of higher density waters through the entrance channel to Subic Bay on either slope of predicted high water.

Maximum current speed was 0.4 knot. Characteristically, flow direction at intermediate levels often differed from the flow of the surface and near-bottom depths.

10. Distribution Statement (con.)

"Approved for public release; distribution unlimited."

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S/N 0101-807-6801

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UNCLASSIFIED
Security Classification

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Security Classification